

Remarks

Reconsideration and allowance of the subject application are respectfully solicited.

Initially, Applicants request that the Examiner provide a clearer copy of the initialled Form PTO-1449 dated September 24, 2003, which was forwarded with the above-identified Office Action. The received form was illegible.

Claims 1, 4-10 and 13-18 are now pending in the application, with Claims 1 and 10 being independent. Claims 3 and 12 have been cancelled without prejudice. Claims 1 and 10 have been amended herein to include the features of Claims 3 and 12, respectively.

Claims 1, 3-10 and 12-18 were rejected under 35 U.S.C. § 103 as being unpatentable over European Patent Application No. 0 496 533 (Yano et al.) in view of U.S. Patent No. 6,109,734 (Kashino et al.). This rejection is respectfully traversed.

As is recited in independent Claim 1, the present invention relates to a method of filling a buffer portion in a print head with at least one bubble, using a print head comprising a plurality of ejection openings through which ink is ejected, a plurality of channels that are each in communication with a corresponding one of the plurality of ejection openings, a common liquid chamber for supplying ink to the plurality of channels, a buffer portion located at an end of an arrangement direction of the channels and adjoining, in the arrangement direction of the channels, at least one of the channels in communication with at least one corresponding ejection opening to restrain vibration of ink in the common liquid chamber which occurs as a result of ejection of the ink, and bubble

generating means for filling the buffer portion with at least one bubble. The method includes the steps of filling the buffer portion with the at least one bubble by driving the bubble generating means and executing a recovery process of discharging the ink through the ejection openings after the bubble filling step. In the recovery process step, excess of the at least one bubble filled in the buffer portion is removed. During the bubble filling step, the at least one bubble is allowed to grow up to a location of the channel adjacent to the buffer portion by driving the bubble generating means.

As is recited in independent Claim 10, the present invention relates to a printing apparatus able to print an image on a printing medium, using a print head comprising a plurality of ejection openings through which ink is ejected, a plurality of channels that are each in communication with a corresponding one of the plurality of ejection openings, a common liquid chamber for supplying ink to the plurality of channels, a buffer portion located at an end of an arrangement direction of the channels and adjoining, in the arrangement direction of the channels, at least one of the channels in communication with at least one corresponding ejection opening to restrain vibration of ink in the common liquid chamber which occurs as a result of ejection of the ink, and bubble generating means for filling the buffer chamber with at least one bubble. The apparatus includes a recording process means which causes the ink to be discharged through the ejection openings after the bubble generating means has filled the buffer portion with at least one bubble and discharges the ink through the ejection openings to remove excess of the at least one bubble. The bubble generating means allows the at least one bubble to grow up to a location of the channel adjacent to the buffer portion.

With the above arrangement and method, because the at least one bubble is allowed to grow up to a location of the channel adjacent to the buffer portion, a state in which there is an inadequate volume of bubble in the buffer portion can be reliably avoided. Any overflow of the at least one bubble can reach the adjacent channel and be removed. That is, any bubble excess can be reliably removed. As a result, the desired buffer effect is reliably achieved.

Yano et al. describes an ink jet printer that introduces air bubbles in an ink chamber to function as buffers. The buffers can absorb discharge energy in the form of pressure waves directed toward the common liquid chamber so that refilling after discharge can be quickly performed. The Office Action refers to col. 20, lines 10-12 of Yano et al. for allegedly teaching that the bubble is allowed to grow up to a location of a channel adjacent to a buffer chamber. However, this section of Yano et al. merely states that “the air bubbles which stay between the adjacent discharge ports and the liquid passage are discharged.” There is no disclosure or suggestion in Yano et al. that at least one bubble is allowed to grow up to a location of a channel adjacent to a buffer portion, as is recited in independent Claims 1 and 10.

Thus, Yano et al. fails to disclose or suggest important features of the present invention recited in independent Claims 1 and 10.

In the ink jet head of Kashino et al., a buffer chamber is provided to absorb back-pressure waves. Bubble cells 306 can be formed with partition walls 312 separating the cells from common liquid chamber 302. However, Kashino et al. is also not believed to disclose or suggest that at least one bubble is allowed to grow up to a location of a

channel adjacent to a buffer portion. Thus, Kashino et al. fails to remedy the deficiencies of Yano et al. noted above with respect to the independent claims.

Thus, independent Claims 1 and 10 are patentable over the citations of record. Reconsideration and withdrawal of the § 103 rejection are respectfully requested.

For the foregoing reasons, Applicants respectfully submit that the present invention is patentably defined by independent Claims 1 and 10. Dependent Claims 4-9 and 13-18 are also allowable, in their own right, for defining features of the present invention in addition to those recited in their respective independent claims. Individual consideration of the dependent claims is requested.

This Amendment After Final Rejection does not raise new issues (because it only incorporates features from dependent claims into independent claims), is an earnest attempt to advance prosecution and reduce the number of issues, and is believed to clearly place this application in condition for allowance. This Amendment was not earlier presented because Applicants earnestly believed that the prior Amendment placed the subject application in condition for allowance. Accordingly, entry of this Amendment under 37 CFR 1.116 is respectfully requested.

Applicants submit that the present application is in condition for allowance. Favorable reconsideration, withdrawal of the rejection set forth in the above-noted Office Action, and an early Notice of Allowability are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,


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